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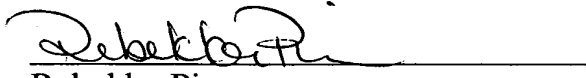
Docket No.: ZTP03P01030

CERTIFICATION

I, the below named translator, hereby declare that: my name and post office address are as stated below; that I am knowledgeable in the English and German languages, and that I believe that the attached text is a true and complete translation of PCT/EP2004/007446, filed with the German Patent Office on July 7, 2004.

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

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Pump with an integrated motor

The present invention relates to a pump with an integrated, electronically commutated wet-running motor.

In a conventionally designed pump with an integrated, electronically commutated motor, a shaft with a rotor of the motor rotates in a rotor chamber, and an impeller of the pump rotates in a hydraulic chamber. A bearing plate is located between the two chambers and has a sliding bearing for mounting the shaft, and a sealing rubber, in order to protect the sliding bearing against contamination and corrosion caused by the water. This bearing plate prevents water flowing from the hydraulic chamber to the rotor chamber. The water can enter the rotor chamber if there is a fault in the sealing rubber. Damage may be caused in the sliding bearing and in the rotor chamber on account of this contamination by the water and corrosion. The conventional design also has the disadvantage that the sliding bearing becomes worn on one side on account of the weight of the rotor.

The object of the invention is to specify a pump which has an integrated, electronically commutated wet-running motor and is protected against damage in a simple manner.

The object is achieved in that the pump has an integral pump chamber which contains a rotor of the wet-running motor. This design allows the pump chamber to be continuously cleaned during the pumping process by water flowing through, so that the water is not severely contaminated. A further advantage is that, with this design, the rotor can be cooled by water flowing through.

1 According to one preferred embodiment, provision is
2 made for the pump chamber to be formed by a front
3 housing shell and a shield of the motor. In this way,
4 it is possible to reduce the dimensions of the pump
5 since it is possible to dispense with a bearing plate
6 between the rotor and an impeller of the pump.

7
8 The shield is preferably in the form of a pot. The
9 rotor can therefore be surrounded by the shield with
10 the smallest possible intermediate space, this
11 resulting in a large amount of the physical volume of
12 the motor being utilized.

13
14 According to one preferred embodiment, provision is
15 made for the pump to have a shaft which is installed
16 such that it cannot rotate, and on which the rotor is
17 mounted such that it can rotate. The shaft is
18 advantageously mounted in the shield, in particular for
19 damping vibration in at least one O-ring which is
20 preferably made from rubber.

21
22 In one preferred embodiment, the rotor is mounted on
23 the shaft by means of at least one radial sliding
24 bearing. The service life of the sliding bearing is
25 increased in this way, since it rotates on the shaft
26 together with the rotor.

27
28 The radial sliding bearing is preferably held in the
29 rotor by means of an O-ring. Tolerances in the sliding
30 bearing holder of the rotor can therefore be
31 compensated for by the elastic O-ring, so that the
32 sliding bearing is seated concentrically on the shaft.
33 Furthermore, vibration of the rotor is damped by the O-
34 ring, so that the need to damp vibration of the shaft
35 can be reduced.

36

1 The rotor is preferably mounted on the shaft by means
2 of an axial bearing. This has the advantage that the
3 axial bearing reduces axial play of the rotor.

4
5 The sliding bearing and/or the axial bearing preferably
6 have/has a liquid seal, in particular with a sealing
7 rubber and/or an O-ring. In this way, the sliding
8 bearing and/or the axial bearing are/is sealed during
9 the pumping process, so that water is prevented from
10 flowing through the sliding bearing and/or through the
11 axial bearing, and therefore no corrosion can occur in
12 the bearings.

13
14 According to one preferred embodiment, provision is
15 made for the rotor to have an interior which is divided
16 into two subregions which run toward one another in a
17 conically tapering manner. In this way, a weak point is
18 provided in two parts for water entering and freezing
19 in the interior, as a result of which the tensile
20 stresses which act on the rotor in the radial and axial
21 directions can be reduced. The two subregions are
22 particularly arranged between two radial sliding
23 bearings which are held in the rotor with an elastic O-
24 ring in each case, so that the freezing water can
25 expand in the axial direction on account of the radial
26 sliding bearings shifting slightly.

27
28 According to one preferred embodiment, provision is
29 made for the rotor to have an impeller. The impeller is
30 preferably integrally formed on the rotor. This
31 simplifies assembly of the pump since the number of
32 separate components is reduced.

33
34 The rotor is preferably encased in plastic. This
35 ensures, in a simple manner, that the rotor is water-
36 tight. Furthermore, it is therefore particularly easy
37 to integrally form the rotor and the impeller from
38 plastic.

1
2 Further features and advantages of the invention can be
3 found in the following description of two exemplary
4 embodiments with reference to the attached figures 1
5 and 2.

6
7 Figure 1 shows a first embodiment and figure 2 shows a
8 second embodiment of a section through the inventive
9 pump with an integrated, electronically commutated wet-
10 running motor.

11
12 According to figure 1 and figure 2, the housing of the
13 pump 1 comprises a front housing shell 2 and a pot-like
14 shield 3, which are both connected to one another in an
15 interlocking manner. The housing of the pump 1 forms an
16 integral pump chamber 4 whose interior contains a rotor
17 5 with an impeller 6. The impeller 6 is preferably
18 integrally formed on the rotor 5.

19
20 The rotor 5 is mounted, such that it can rotate, on a
21 shaft 9 by means of a front sliding bearing 7, which
22 faces the impeller 6, and by means of a rear sliding
23 bearing 8, which faces the shield 3. According to
24 figure 1, in order to prevent axial movement of the
25 rotor 5 on the shaft 9, the rotor 5 is fixed at its two
26 ends by means of a clamping ring 10, 11 in each case.
27 The rotor 5 also has an axial bearing 12 at its front
28 end, which faces the impeller 6, for reducing the axial
29 movement, with a mount for an O-ring 13 between the
30 axial bearing 12 and the sliding bearing 7. The O-ring
31 13 prevents liquid, in particular water, from entering
32 the sliding bearing 7 and elastically centers said
33 sliding bearing in the radial direction. A rubber shock
34 absorbing means 14 is inserted between the axial
35 bearing 12 and the clamping ring 11.

36
37 At its front end, which faces the impeller 6, the shaft
38 9 is mounted, such that it cannot rotate, in a seat 15

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1 which is fixed by carrying arms 16 on the front housing
2 shell 2, and at its rear end, which faces the shield 3,
3 the shaft 9 is mounted, such that it cannot rotate, in
4 a seat 17 which is formed in the shield 3. A
5 compensating element 18, which is preferably in the
6 form of a rubber disk, is inserted in the seat 17 of
7 the shield 3, in order to be able to compensate for
8 axial changes in the length of the shaft 9 when the
9 temperature fluctuates. In the first embodiment
10 according to figure 1, the shaft 9 is fixed in the seat
11 17 of the shield 3 by means of an O-ring 19 in the
12 radial direction. The O-rings 13, 19 and the
13 compensating element 18 are particularly made from
14 rubber, so that vibration of the rotor 5 and therefore
15 of the shaft 9 can be absorbed.

16

17 In order to protect the permanent magnets 20 of the
18 rotor 5 against corrosion, the entire rotor 5 is
19 encased in plastic. The impeller 6 of the pump 1 is
20 formed on the rotor 5 from the same plastic. The rotor
21 5 and the impeller 6 can therefore be integrally
22 produced. This integral design is not absolutely
23 necessary but has the advantage that the number of
24 components is lower and the problem of fixing the
25 impeller 6 on the rotor 5 is avoided.

26

27 A stator 21 of the wet-running motor is arranged
28 outside the pot-like shield 6, and the rotor is
29 therefore a so-called internal rotor. An embodiment in
30 the form of an external rotor is also possible. The
31 stator 21 is electrically connected to an electrical
32 actuating circuit, which is arranged on a printed
33 circuit board 23, by a spring contact 22. In this way,
34 the pump 1 can be installed without a special soldering
35 tool. The printed circuit board 23 is covered by a rear
36 housing shell 24 which is connected to the stator 21
37 and the pot-like shield 3 by means of screws 25.

38

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1 In order to improve the flow properties within the
2 impeller 6, a shaped head piece 26 is seated on the
3 shaft 9 as a termination piece in front of the front
4 clamping ring 11, which faces the impeller 6, and
5 separates the clamping ring 11 from the water-bearing
6 region 27 of the impeller. The shape of the head piece
7 26 is matched to the shape of the impeller 6 in such a
8 way that flow resistance is minimal. A gap seal 28 is
9 formed between the impeller 6 and the front housing
10 shell 2, and the impeller 6 rotates in said gap seal.

11

12 In the second embodiment according to figure 2, the
13 radial sliding bearings 7, 8 are held in the rotor 5 by
14 means of a respective elastic O-ring 30, 31. These O-
15 rings 30, 31 are firstly used to compensate for
16 tolerances in the sliding bearing holder of the rotor
17 5, so that the sliding bearings 30, 31 are seated
18 concentrically on the shaft 9. Secondly, the elastic O-
19 rings 30, 31 are used to damp vibration of the rotor 5.
20 Therefore, in comparison to the first embodiment
21 according to figure 1, it is possible to dispense with
22 the O-ring 19 in the seat 17 of the shield 3 and the
23 rubber shock absorbing means 14 for damping vibration
24 of the shaft 9. Furthermore, the function of the
25 clamping ring 11 according to figure 1 is already
26 integrated in the head piece 26 in the second
27 embodiment, so that this further component can be
28 dispensed with too.

29

30 Between the two sliding bearings 7, 8, the internal
31 space in the rotor 5 is divided into two subregions 32,
32 33 which run toward one another in a conically tapering
33 manner. If water enters this internal space in the
34 rotor 5 between the two sliding bearings and freezes,
35 it splits into two parts corresponding to the
36 subregions 32, 33. These two parts can push the radial
37 sliding bearings 7, 8 slightly outward in the axial
38 direction upon expansion, so that tensile stresses on

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1 the rotor 5 are reduced both in the radial and in the
2 axial directions.

3

4 The pump 1 is designed particularly for use in domestic
5 appliances containing water, for example dishwashers.